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AUTHOR	Scharmann, Larry, Ed.; Lay, Gary, Ed.
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ABSTRACT

Intended primarily but not solely for use at the postsecondary level, this curriculum guide contains six units on energy efficiency that were designed to be incorporated into an existing program in automobile mechanics. The following topics are examined: drivers and public awareness (relationship between driving and fuel consumption); ignition systems (modifications that can be performed on the electrical system to maximize fuel efficiency); the fuel system (correct adjustments, calibrations, and possible modifications of the carburetor and fuel pump); brakes and suspension systems (alignment, shocks, wheel balance, tires, brakes, and their effect on driver comfort and vehicle fuel economy); transmissions (ways to conserve energy); and alternate fuel sources (including engine modifications necessary for their utilization). Covered in each lesson are unit rationale, necessary advanced preparations, anticipated instructional time, guidelines for implementing the unit, unit activities, and unit references. (MN)

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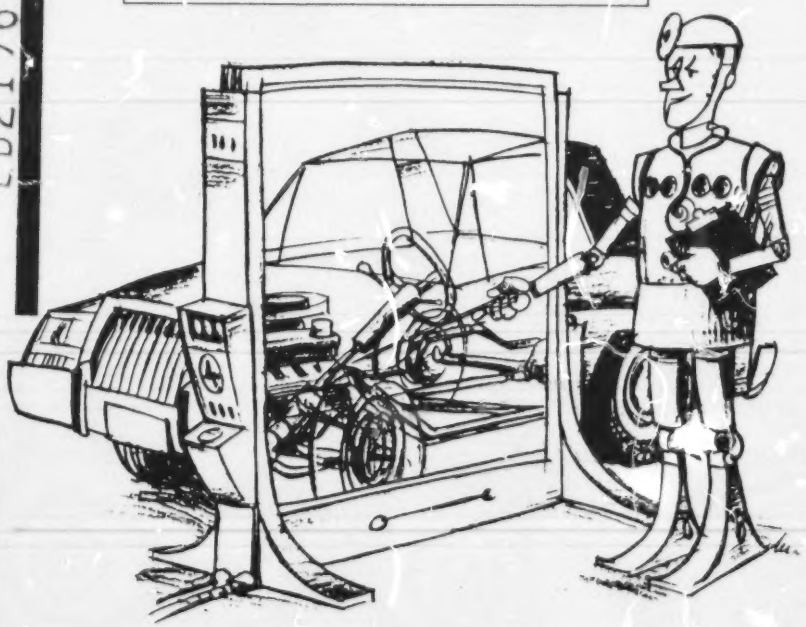
ENERGY EFFICIENCY FOR AUTOMOTIVE INSTRUCTORS



co-edited by:

Larry Scharmann and Gary Lay
For the Nebraska Energy Office

V.B. Balok
Director

Leo Scherer
Deputy Director

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G. LAY

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PREFACE

This curriculum guide was produced by the Nebraska Energy Office in a cooperative effort with the Nebraska State Department of Education. These organizations realize the importance of energy conservation as it affects both the individual and the State of Nebraska.

The following individuals assisted with the production of these materials:

Lowell Fenster, Auto Mechanics Instructor, Mid-Plains Technical Community College, North Platte, Nebraska.
Ronald Jantzi, Supervisor - Trade and Industrial Education, Nebraska State Department of Education.
Gary Lay, Energy Programs Manager, Nebraska Energy Office.
Gary Minnick, Auto Mechanics Instructor, Central Technical Community College, Hastings, Nebraska.
Willie Quindt, Auto Mechanics Instructor, Western Technical Community College, Scottsbluff, Nebraska.
Larry Scharmann, Education Coordinator, Nebraska Energy Office.

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These materials will be piloted during the 1980-81 school year, revised, and subsequently made available statewide in the 1981-82 academic year.

All inquiries, suggestions, or comments regarding these materials should be directed to:

Gary Lay, Energy Programs Manager or
Larry Scharmann, Education Coordinator
Nebraska Energy Office
Box 95085
Lincoln, Nebraska 68509
(402) 471-2867

INTRODUCTION

This curriculum guide contains six units that were designed to be incorporated into an existing program in automotive mechanics. The material is primarily intended for use at the post-secondary level. A well-equipped secondary instructor, however, will also find the information useful.

The six units may be taught independently or collectively depending on the needs of the instructor at any single institution. The content of these units has been written in an outline format. Each unit outline, in order to facilitate articulation between units, consists of the following sections: rationale, advanced preparation, anticipated instructional time, unit guide, activities, and references.

The overall objective of this curriculum guide is to provide the automotive instructors in Nebraska with a format to achieve continuity in their approach to teaching automotive energy efficiency.

Course Rationale

This course is designed to present energy efficiency in the automobile through the following six units:

1. The Driver and Public Awareness - tries to establish a better understanding of the relationship that exists between driving techniques and fuel consumption.

2. Ignition Systems - deals with modifications that can be performed on the electrical system to maximize fuel efficiency.

3. The Fuel System - is the key to an efficient automobile. This unit encompasses the importance of correct adjustments, calibrations, and possible modifications of the carburetor and fuel pump.

4. Brakes and Suspension Systems - covers alignment, shocks, wheel balance, tires, brakes, and their effects as related to driver comfort and vehicle fuel economy.

5. Transmissions - are usually overlooked as a possible source of increasing efficiency. This unit deals with ways to conserve energy in the drive train.

6. Alternate Fuel Sources - explores alternate sources of fuel in the automotive industry and engine modifications necessary in the utilization of these fuels.

The degree of coverage depth, instructional time, and evaluation of student performance are left at the discretion of the individual instructor. Activities are included but are by no means comprehensive. Instructors should feel free to add, delete, or substitute activities, references, and audio-visual materials. The Nebraska Energy Office encourages innovation to better suit the needs of the individual instructor.

NOTE: It is suggested that the following equipment be used to obtain optimum results throughout the study of these units: scope, distributor machine, infra-red tester, compression guage, timing light, dwell meter, and tachometer.

UNIT I

THE DRIVER AND PUBLIC AWARENESS

RATIONALE

The 55 mph speed limit is saving 1 1/2 billion gallons of gas a year. If we were all to abide by this limit, over 3 billion gallons could be saved. This represents almost 3% of our nation's fuel consumption per year.

The preceding is only one example of how the average motorist can reduce fuel consumption. This unit explores several methods for conserving gasoline through good driving habits and systematic car care.

ADVANCED PREPARATION

It is recommended that the publications "Energy Efficiency Handbook for Drivers Education" and "Money Saving Tips for Nebraska Motorists" be obtained from the Nebraska Energy Office prior to beginning this unit.

ANTICIPATED INSTRUCTIONAL TIME

1 to 3 weeks

UNIT GUIDE

1. Maintain systematic car care
   A. Change oil and filter at recommended intervals.
   B. Chassis lubrication.
   C. Check air and fuel filters at recommended intervals.
   D. Check tire pressure at least once a month.
   E. Check wheel alignment at least once a year.

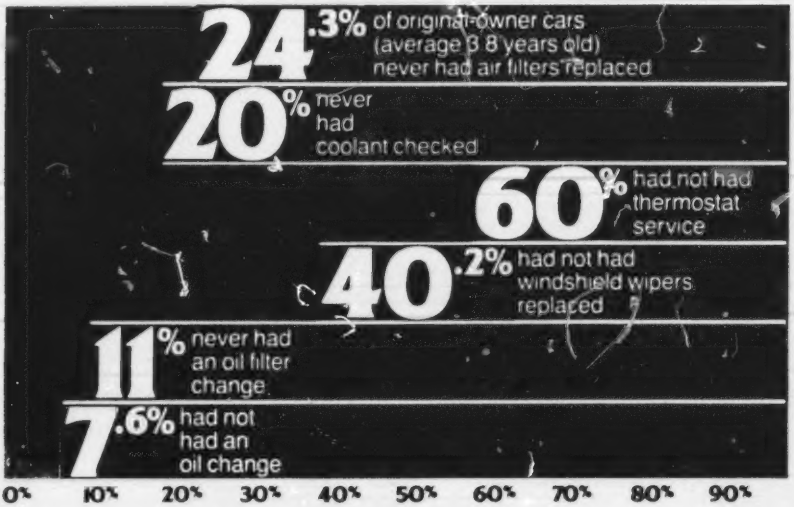
2. Avoid sudden starts and stops
   A. Avoid Jackrabbit starts - hot rod, spin-out starts and jerky acceleration can increase fuel consumption by 2 miles per gallon in city traffic.
   B. Accelerate briskly, but smoothly, up to 30 mph. . . then moderately up to 55. At 55, keep a steady pressure on the accelerator. . . just enough to maintain speed.

3. Anticipate traffic conditions
   A. Learn to judge stoplight durations; that red light will probably turn to green before you stop if you've slowed down gradually.
   B. Any car momentum you can conserve is better than none. It takes up to six times as much gas to move a car from a dead stop than it does if it is moving just a few miles per hour.
   C. Keep an eye on the traffic at least two cars ahead and avoid stop-and-go, gaswasting situations.
   D. If you're at a stoplight and plan to turn right, don't waste gas by sitting at the light! Go ahead and turn if traffic is clear and if it's legal.

WHY VEHICLES SHOULD BE CHECKED ANNUALLY

...MOST VEHICLES ARE UNDERMAINTAINED

42% of the nation's car fleet have defects which affect safe operation
—Insurance Institute for Highway Safety



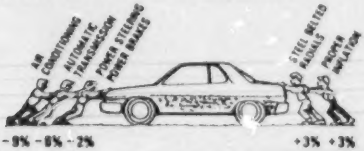
—Motor Equipment Manufacturers Association Survey of 10,000 households

E. Unnecessary braking and stopping mean more acceleration and use of more gas to get back to speed. Each time you double your rate of acceleration, you use twice the amount of gas than if you cruised at a steady speed.

F. Varying your speed on the highway even by as little as five mph can reduce fuel economy by as much as 1.3 miles per gallon.

G. Don't tailgate! Much gas is wasted by driving too close to the car ahead. You must constantly brake and accelerate, brake and accelerate.

4. Avoid excessive use of accessories



5. Plan your trips carefully
   A. Combine trips
      1. Store
      2. Post Office
      3. School

6. Consider the pedestrian and cyclist
   A. Motorist - the driver should be aware of the driving conditions. Keep in mind the possible actions of the pedestrian and cyclist.
   B. Pedestrian & cyclist - the pedestrian or cyclist should not take action that would interfere with the normal flow of traffic.

7. Fuel your car safely
   A. Avoid over filling.
   B. Use recommended fuel (leaded or nonleaded).

8. What motor vehicle manufacturers are doing
   A. Smaller vehicles.
   B. Less accessories.
   C. Improved energy conservation components such as engine transmissions.

UNIT ACTIVITIES

The following worksheets can be used as a before and after check with Unit I as well as with Units II - V. The post check after Unit I will confirm the fuel economy increase due to better driving habits. The post check after each of Units II - V will confirm fuel economy increases due to modifications made on ignition, fuel, brake and suspension, and drive train systems. You may wish students to check their miles-per-gallon ratings upon the successful completion of each unit.

UNIT REFERENCES

"Money Saving Tips for Nebraska Motorists"
From: Nebraska Energy Office
Box 95085
Lincoln, NE 68509 .

"The Driving Skills Book"
From: Shell Answer Book
P.O. Box 61609
Houston, Texas 77208

"You & Your Driving"
From: Exxon Company
Available through the Nebraska Energy Office

"Your Way To Better Fuel Economy"
From: Nebraska Energy Office
Box 95085
Lincoln, NE 68509

"Free MPG"
From: Motor Trend
April 1980 Issue
Consumer Information Center
Pueblo, Colorado 81009

"Energy Efficiency Handbook for Driver's Education"
From: Nebraska Energy Office
P.O. Box 95085
Lincoln, NE 68509

FILMS

Library Journal
R.R. Bowker Co.
Subscription Department
P.O. Box 67
Whitinsville, MA 01588

"Driving for Economy"
General Motor Corp.
Cadillac Division

"Drive for Conservation
ARCO Company
Available from the Nebraska Energy Office

STUDENT ACTIVITY WORKSHEET #1

PRESENT DRIVING HABITS

It is suggested that each student complete this chart to the best of his/her ability.

It is recommended that each student start and finish with a full tank of fuel.

2 week period

DATE	MILES AT FILLUP		MILES DRIVEN	COST	MPG	COST PER MILE	TYPE OF DRIVING
	LAST	THIS					
TOTALS							

STUDENT ACTIVITY WORKSHEET #2

DRIVING HABITS AFTER UNIT #1

It is suggested that each student complete this chart to the best of his/her ability.

It is recommended that each student start and finish with a full tank of fuel.

2 week period

DATE	MILES AT FILLUP LAST	MILES AT FILLUP THIS	MILES DRIVEN	COST	MPG	COST PER MILE	TYPE OF DRIVING
TOTALS							
			% CHANGE				

STUDENT ACTIVITY WORKSHEET #3

DRIVING HABITS AFTER TUNE-UP & ENGINE MODIFICATIONS

It is suggested that each student complete this chart to the best of his/her ability.

It is recommended that each student start and finish with a full tank of fuel.

2 week period

DATE	MILES AT FILLUP LAST	MILES AT FILLUP THIS	MILES DRIVEN	COST	MPG	COST PER MILE	TYPE OF DRIVING

UNIT II

IGNITION SYSTEM

RATIONALE

The completion of an electrical system tune-up will make major contributions in conserving energy and improving fuel efficiency. It must, however, be performed properly to ensure driver comfort and drivability of the automobile. Thus, proper test equipment is essential in achieving a proper tune-up.

A second method of increasing efficiency involves ignition system modification. Many modification techniques, however, result from experienced, trial and error. Care must be taken to stay within the guidelines of manufacturer's specifications or you may risk voiding a warranty.

This unit, therefore, explores several mechanical techniques and modifications that can be performed to increase the efficiency of the engine's electrical system.

ADVANCED PREPARATION

The student must have access to an automobile in order to perform the activities within this unit.

This unit requires the availabiltiy and use of the following equipment: compression guage, scope, distributor machine, timing light, infra-red tester, dwell meter, and tachometer.

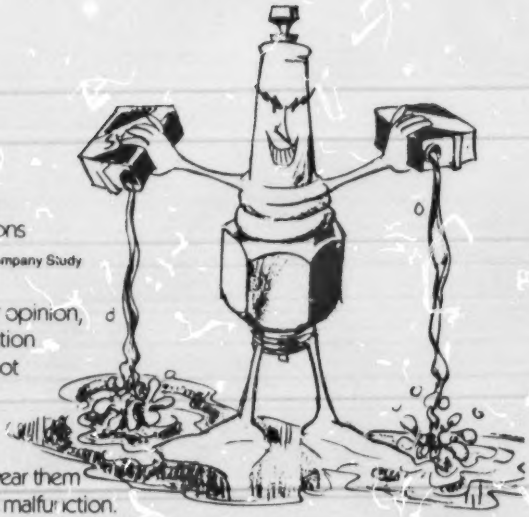
No specific text or literature is essential for this unit since it requires performing many "hands-on" tasks.

ANTICIPATED INSTRUCTIONAL TIME

3 to 4 weeks

UNIT GUIDE

1. Make sure engine is mechanically sound
   A. Compression or cylinder leakage test.
      1. Low compression greatly affects the tuneability of any vehicle.
      2. All mechanical problems should be cured before the vehicle can be effectively tuned for energy efficiency.
   B. External leakages.
      1. Oil.
         a. valve covers.
         b. oil pan, oil filter, drain plug.
         c. timing cover seals, rear main seals.
      2. Coolant
         a. water pump.
         b. radiator.
         c. all hoses, clamps.

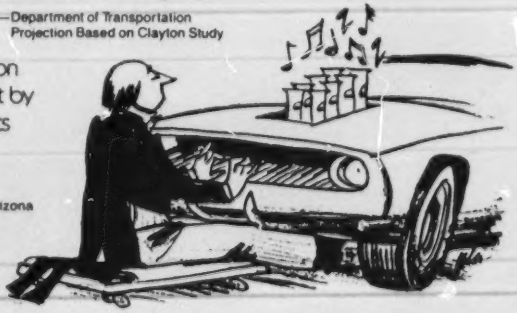


One mis-firing spark plug can waste up to two gallons per tankful —American Oil Company Study

Contrary to some popular opinion, spark plugs and other ignition system components do not fail suddenly like a light bulb. The effects of heat, electricity, chemical attack and other factors wear them gradually, causing them to malfunction. Thus engine efficiency is hampered, with resultant waste in fuel, performance and starting ability. That is why we recommend at least annual replacement of spark plugs as part of a tune-up.

—David L. Walker, Technical Services Director
Champion Spark Plug Company
Testimony to California Air Resources Board

Tuned vehicles could save five billion gallons of gasoline a year —Department of Transportation
Projection Based on Clayton Study



Gasoline consumption by 2,500 car fleet cut by 10% after adjustments necessary to meet emission standards

—City of Phoenix, Arizona

11.36% improvement average in fuel economy after tune-up

—Champion Spark Plug Company MPG National Study

3. Fuel
   a. fuel pump diaphragm.
   b. fuel tank and lines.
   c. external carburetor.
4. Vacuum
   a. distributor vacuum diaphragm.
   b. storage container and related housings.
   c. P.C.V. valve, E.G.R. valve, etc.
   d. base of carburetor and throttle shaft.
   e. choke unloader diaphragm.

2. Distributers
   A. A distributor in good mechanical condition will help engine energy efficiency.
      1. mainshaft bushings and mainshaft wear.
      2. cam lobe wear (dwell variation).
      3. distributor vacuum diaphragm (leak).
      4. drive gear wear and shaft end play.
      5. worn or dry advance weights.
      6. broken advance springs or broken advance stops.
   B. Proper mechanical and vacuum advance curves.
      1. check distributor I.D. number for proper application.
      2. check vacuum advance per specification through complete operating range.
      3. check distributor mechanical advance curve against factory specifications in all R.P.M. ranges.
   C. Correct adjustments
      1. spring tension on points (if it applies).
      2. air-gap points or pick up unit (if it applies).
   D. Condensor (if used):
      1. resistance
      2. leakage
      3. capacity

3. Secondary ignition system condition
   A. Rotor and distributor cap.
      1. check for cracks.
      2. check terminal continuity.
   B. Spark plugs
      1. reach (correct plug for application).
      2. heat range (correct plug for application).
      3. brand (correct plug for application).
   C. Secondary wires
      1. check visual condition (broken, burned, oil soaked).
      2. check ohm meter (follow suggested manufacturers specifications).

   D. Coil
      1. primary resistance.
      2. secondary resistance.
      3. possible open or grounded circuit.
      4. available voltage.

4. Charging system
   A. Charging system voltage.
      1. excessive charging-system voltage could cause unnecessary pull on the generator or alternator thus causing wasted fuel or poor economy.
      2. excessive charging voltage also puts undue strain on the ignition system contact points and condensor. This would cause premature failure and thus adversely affect energy efficiency.

5. Starting system
   A. Cranking voltage and amperage draw
      1. excessive cranking amperage draw could cause the alternator or generator to work harder to produce the amperage necessary in recharging the battery.

UNIT ACTIVITY

The student should perform a complete electrical system check and "hands-on" tune-up as per manufacturers specifications.

MODIFICATION ACTIVITIES

1. Ignition system modification (Some suggested activities)
   A. Alter initial timing
      1. advance or retard initial timing to aid mechanical operation and fuel economy.
   B. Modify distributor advance curve as may be required.
      1. establish major type of vehicle use, set advance curve to correspond.
      2. early or delayed advance in relation to R.P.M. and load may be helpful:
         a. change in spring tension or weight design affects the above.
         b. use of distributor machine is a must for complete energy efficiency set-up.
   C. Close inspection of spark plugs.
      1. read plug as to correct heat range (cold or hot).
      2. read plugs as to correct fuel mixture (rich or lean).
      3. check and adjust for physical defects (threads, broken ceramic, proper gap, etc.)
   D. Replace original equipment
      1. distributor (complete)
         a. dual point (longer total dwell).
         b. change from points type to full electronic type.
      2. distributor (partial)
         a. convert stock points type distributor to magnetic or electronic pickup type (with replacement kits).
      3. secondary wires
         a. solid core type
            1. less resistance may have radio interference.

b. carbon core or equal type
   1. more resistance; no radio interference.
   2. silicone type cover adds life to all wires.

4. hotter coil
   a. more available voltage to secondary system on demand for a specific condition.
5. economy cams
   a. lift, duration, overlap, other engine accessories plus actual vehicle design and intent must be taken into consideration before such a change is made.
6. alter compression ratio
   a. high compression pistons are available to dealerships and parts stores. Type of fuel and knowledge of vehicle use are required to successfully approach either 4 and/or 5.

NOTE: Regarding Emissions Hardware and Fuel Economy

If you try to outsmart emissions hardware, you might outsmart yourself.

Today's cars are designed for the best combination of fuel economy and emissions control. Catalytic converters, for example, don't rob fuel, they allow engineers to tune the engine for better mileage and still meet air pollution standards.

If you want to work on your car for maximum economy, keeping it maintained to specifications is your best bet. Don't risk voiding your warranty or throwing part of a complicated system out of whack.

UNIT REFERENCES

"Hi-performance & Racing - Heat Range Chart & Tuning Guide"
From: Champion Spark Plugs Co.
P.O. Box 910
Toledo, Ohio 43601

"How To Tune Your Car"
From: Peterson Publishing Co.
8490 Sunset Blvd.
Los Angeles, CA 90069

"Tuning Down Auto Air Pollution"
From: Nebraska Energy Office
Box 95085
Lincoln, NE 68509

UNIT III

FUEL SYSTEMS

RATIONALE

The fuel system dates back to the early 1900's. The first original carburetor was called the "Iron Pot." It appeared on the curved dash "Olds" in 1904. Today, however, there are many different types, styles, and manufacturers of carburetors and complete fuel systems.

Fuel, air, and spark are required to operate the internal combustion engine. Fuel, however, is a nonrenewable source of energy and must be wisely utilized in order to achieve maximum efficiency.

The improperly adjusted fuel system is perhaps the single biggest contributor to fuel waste. It is therefore a key to improving an automobile's fuel efficiency. This unit encompasses the importance of correct adjustment and calibration procedures with regard to the carburetor. It additionally discusses possible modificatons that can be performed on the fuel system.

ADVANCED PREPARATION

Students must have access to an automobile in order to perform the activities within this unit.

It is necessary to provide students with a carburetor identification guide as well as a fuel filter guide, (N.A.P.A. is one possible resource).

ANTICIPATED INSTRUCTIONAL TIME

1 to 3 weeks

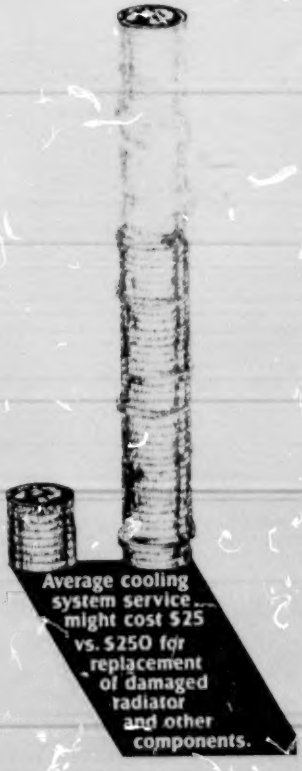
UNIT GUIDE

1. Complete inspection of fuel system
   A. Check lines, hoses and tank for leaks.

2. Proper identification of carburetors (see N.A.P.A. Carburetor Identification Guide).

   A. Correct specifications are a must; the N.A.P.A. shows location of carburetor identification numbers.

3. Understand and be able to check all carburetor circuits
   A. Float (proper level, possible leak).
   B. Idle (proper R.P.M. air/fuel mixture, and adjustment on idle screws).
   C. Main (proper jet size for carburetor identification number).
   D. Power (proper metering rod, power valve, etc.).
   E. Accelerator pump (in good working condition).
   F. Choke (proper setting, linkage adjustment working free).



Overall emissions reduction after tune-ups: CO 45%, HC 56%

4. Fuel pump (mechanical or electrical).
   A. Volume
      1. make test for volume as per manufacturers specifications.
   B. Pressure
      1. use tester to see if pump lbs. per square inch are equal to manufacturers specifications.
5. Carbon canister
   A. Service filter and liner as per manufacturers recommendation (time or miles).

6. Air and fuel filters
   A. Dirty air filters change the air/fuel mixture for which your vehicle was originally designed, check and change as needed.
   B. Fuel filter
      1. make sure the filter is of the proper type and design (see N.A.P.A. fuel filter guide).

UNIT ACTIVITY

The student should perform a complete carburetor cleaning inspection and adjustment as per manufacturers specifications.

MODIFICATION ACTIVITIES

1. Modification of Carburetor
   A. Jet change (small or larger)
      1. two-step increments per trial are recommended (experience is a big factor in the success of a jet change).
      2. jet change will also depend on other modifications such as camshaft, headers, manifold, compression ratio, etc.
   B. Fuel enrichment systems
      1. power valve or economizer valve may be changed, as per spring tension for operation of valve. Opening the valve pressure and/or badly worn valves will greatly increase fuel use in main, idle and off-idle circuits.
      2. metering-rod change (caution: severe changes in main jet size may require a metering-rod change if rods are used in the system).
   C. Experiment with ported or constant vacuum source to distributor
      1. changing from ported to constant vacuum will greatly affect total ignition advance (in a given R.P.M. range or torque range). Trial and error alone will help you determine how much ignition advance is beneficial and what R.P.M. range is required.
   D. Replace factory carburetor with economy carburetor
      1. type and design of the carburetor is important when considering other engine modifications (one barrel, two barrel, four barrel, etc.).
      2. size of carburetor (physical ability to match with manifold bolt pattern, linkage clearance, etc.) is important.
      3. air flow or fuel flow specifications of carburetor is helpful in making proper decision on type, model and manufacturer.

E. Intake or exhaust manifolds can be substituted with economy units.
   1. headers may help performance and economy (as stated before, however, experience is the best teacher). The engine's ability to breath greatly depends upon proper matching of all related parts.
   2. manifolds should be selected for specific use and design (e.g. double-plane small passage; double-plane large passage; single-plane medium passage etc.)

2. Install guages
   A. Vacuum
      1. a vacuum guage monitors driving habits constantly. It is very effective in showing engine energy efficiency.
   B. Tachometer
      1. an accurate measurement of engine revolutions per minute (R.P.M.s) at any road speed.
   C. Fuel saving monitors
      1. there are many types and styles of monitors on the market today that compute energy savings. Use them at your discretion.
   D. Other fuel economy devices
      1. today's media is filled with ads for "gadgets" designed to save fuel and help your car become more energy efficient. You will be able to determine through your experience and investment to what extent they really work.

NOTE: Regarding Emissions Hardware and Fuel Economy

If you try to outsmart emissions hardware, you might outsmart yourself.

Today's cars are designed for the best combination of fuel economy and emissions control. Catalytic converters, for example, don't rob fuel, they allow engineers to tune the engine for better mileage and still meet air pollution standards.

If you want to work on your car for maximum economy, keeping it maintained to specifications is your best bet. Don't risk voiding your warranty or throwing part of a complicated system out of whack.

UNIT REFERENCES

"Holley Carburetors & Manifolds"
From: H.P. Books
P.O. Box 5367
Tucson, AZ 85703

"Diagnostic Guide"
From: Mitchell Manuals, Inc.
P.O. Box 80427
San Diego, CA 92138

"Custom Carbs & Modified Manifold"
From: Motors Magazine (May 1980 Issue)
The Hearst Corporation
224 West 57
New York, NY 10019

FILMS

Film lists may be obtained from the following sources:

Carter Carburetor Co.

Prentice-Hall Publishing Co.
P.O. Box 500
Englewood Cliffs, NJ 07632

United Delco (Division of General Motors)
P.O. Box 2499
Anderson, IN 46011

Bergwall Productions, Inc.
839 Stewart Avenue
Garden City, NJ 11530

Ford Motor Co.
P.O. Box 07150
Detroit, MI 48207

UNIT IV

BRAKES AND SUSPENSION

RATIONALE

Suspensions of the past consisted of many varied but essentially "simple" systems. Included among these many types were the I-beam, axle, leaf spring and spindle bolt types. These systems unfortunately, seldom considered comfort as a high priority.

Today's systems, however, are highly engineered and constructed for a smooth ride. These more "complex" systems are also more fuel efficient. Therefore, incorrect alignment, adjustment, or poor overall condition of the suspension system yields a rough ride and also adversely affects fuel economy.

This unit covers the topics of alignment, shocks, wheel balance, tires, and brakes as they relate to improving the fuel economy of the automobile.

ADVANCED PREPARATION

Students must have access to an automobile in order to perform the activities within this unit.

Pressure guages, alignment, and wheel balancing equipment are necessary for successful completion of this unit.

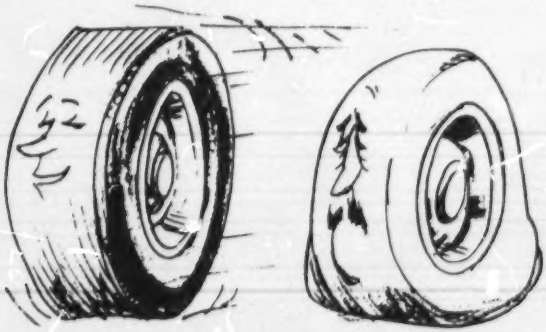
ANTICIPATED INSTRUCTIONAL TIME

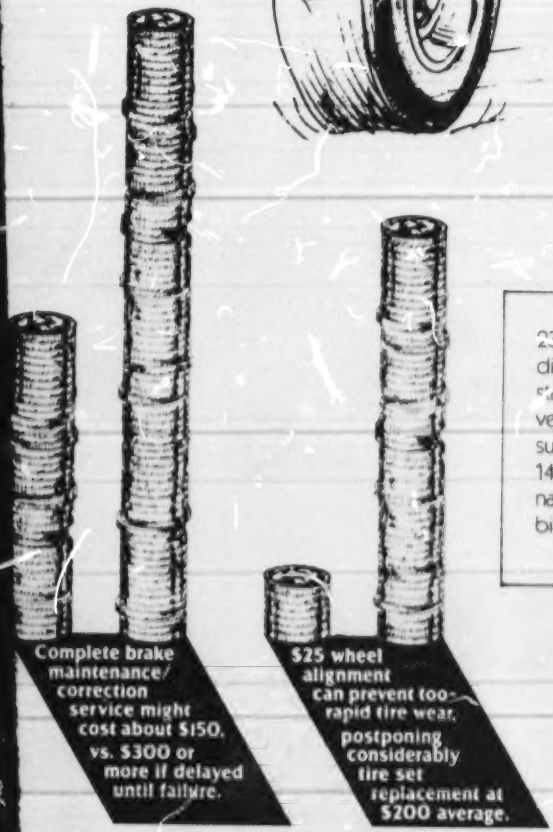
1 to 5 days

UNIT GUIDE

1. Tires
   - A. Pressure
     1. do not over inflate.
     2. do not under inflate.
   - B. Bias VS. radial (properly inflated radial tires add 3-5% fuel mpg in-town).
   - C. Wheel bearing adjustment (adjust to manufacturers specification).
   - D. Size (as per auto manufacturers specification).
   - E. Tread design
     1. conventional tread.
     2. mud and snow tread.
   - F. Wheel balance.
     1. static balance.
     2. dynamic balance.
2. Suspension
   - A. Complete check of front & rear suspension parts.
     1. front and rear shocks.
     2. front and rear springs.
     3. front and rear control arms.

Improper air pressure not only cuts gasoline mileage by about 5%, but it also reduces the life of a tire because of heat build-up —Automotive Information Council




Complete brake maintenance/ correction service might cost about $150, vs. $300 or more if delayed until failure.
$25 wheel alignment can prevent too-rapid tire wear, postponing considerably tire set replacement at $200 average.

23% of 120,000 cars checked did not meet energy efficiency standards. Estimated per-vehicle fuel wastage of these sub-standard cars is as much as 140 gallons per year (or a national projection of 3.2 billion gallons)

—Gulf Oil Company Econo-Check Program

4. steering linkage and stabilizer bars.
5. upper and lower ball joints.

B. Alignment (as per manufacturers specification)
1. caster.
2. camber.
3. toe-in.

3. Brakes
A. Disc brake drag.
B. Proper brake drum adjustment.
C. Proper parking brake adjustment.

UNIT ACTIVITIES

1. Tires
A. Check tire pressure and inflate to maximum recommended (do not over inflate).
B. Check wheel balance (correct if necessary).
C. Check front wheel bearing adjustment (correct if necessary).
D. Make sure tire size matches auto manufacturers specifications.
E. Same tread design on all tires (correct if necessary).

2. Alignment
A. Correct alignment according to factory specifications.
B. Check drum and parking brake adjustments (correct if necessary).

REFERENCES

"Money Saving Tips for Nebraska Motorists"
From: Nebraska Energy Office
Box 95085
Lincoln, NE 68509

"Your Way To Better Fuel Economy"
From: Nebraska Energy Office
Box 95085
Lincoln, NE 68509

"You & Your Driving"
From: Exxon Company
Available through the Nebraska Energy Office

"Wheel Alignment"
From: Applied Power, Inc.
P.O. Box 27207
Milwaukee, WI 53227

UNIT V

TRANSMISSIONS

RATIONALE

The transmission is one component of the drive train that is usually overlooked in a maintenance program concerned with increasing fuel efficiency. The increase is, at present, primarily due to proper care through recommended maintenance practices.

The automotive manufacturers are studying methods to improve the contribution that transmissions/drive train systems can make regarding energy conservation. The ideas being discussed include: overdrives as standard equipment, two speed axles, and decreases in drive train friction. The developments in this area should come to fruition in the early 1980's.

This unit deals with those aspects of the drive train that contribute to fuel economy.

ADVANCED PREPARATION

A manufacturer's service manual or its equivalent is required for each vehicle being used for instructional purposes.

ANTICIPATED INSTRUCTIONAL TIME

1 to 5 days

UNIT GUIDE

1. Automatic transmissions (correct to manufactures specifications)
   A. Get transmission shifted into highest gear as soon as possible.
   B. Put transmission in neutral at railroad crossing when waiting for trains. Turn car off if wait is greater than 30 seconds.
   C. Transmission slippage (correct as necessary).
   D. Erratic shift pattern (correct as necessary).

2. Drive Shaft
   A. Check to see that the universal joints are not worn, loose or bunching and make replacements where necessary.

3. Differential
   A. Check to see if the fluid level is correct and that the seals are not leaking.

UNIT ACTIVITIES

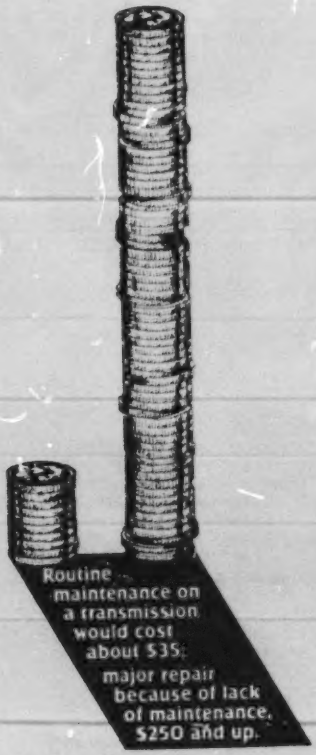
1. Automatic Transmission
   A. Change oil as factory recommends
   B. Change filter as factory recommends
   C. Check band adjustment as factory recommends

UNIT REFERENCES

"Motors Manual"

"Mitchell Manual"

"Chilton Manual"



UNIT VI

ALTERNATE FUEL SOURCES

RATIONALE

It is estimated that if all of the cars on the road were compact models, the United States could save 5.7 billion gallons of gasoline. Unfortunately, this is not the case!

The door is wide open to anyone who can produce a practical fuel that can be termed "renewable". While this may not seem feasible in the near future, it has not stifled our search for alternate sources of non-renewable fuels that can improve fuel efficiency.

This unit is designed to explore the currently popular alternatives to gasoline. Many on-going experiments are being conducted to test the feasibility of these alternate fuels.

ADVANCED PREPARATION

A number of brochures are available from the Nebraska Energy Office that may be useful for instructional purposes. These titles can be found in the section on unit references.

ANTICIPATED INSTRUCTIONAL TIME

1 week

UNIT GUIDE

1. Gasohol
   A. A blend of 10% alcohol and 90% gasoline (per volume). No engine modification is required to use this fuel.

2. Alcohol
   A. Methanol
      1. derived from wood, a renewable resource.
   B. Ethanol
      1. derived from several renewable resources such as grain and products that have cellulose in them (such as organic garbage).

3. Hydrogen
   A. A high energy, low weight fuel. Some problems include cost of production, storage, and method of distribution.

UNIT ACTIVITIES

1. Conversion of gasoline engine for alcohol use shall be left at the discretion of instructor (as per equipment available).

2. It is recommended an engine conversion be made.

UNIT REFERENCES

"Hi-Performance and Racing Heat Range Chart and Tuning Guide"
From: Champion Spark Plug Company
P.O. Box 910
Toledo, OH 43601

"Grain Alcohol - Fuel From the Farm"
From: Nebraska Energy Office
P.O. Box 95085
Lincoln, NE 68509

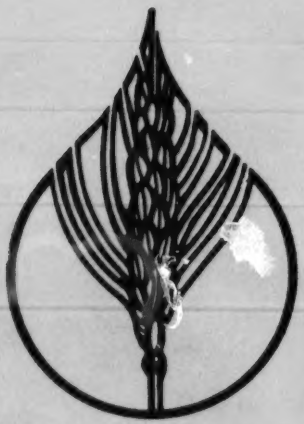
"Agricultural Engineering"
From: Nebraska Energy Office
P.O. Box 95085
Lincoln, NE 68509

"Facts About Gasoline"
From: Ethyl Corporation
Petroleum Chemicals Division
New York, NY 10017

"Hydrogen Fuel"
From: Nebraska Energy Office
P.O. Box 95085
Lincoln, NE 68509

UNIT FILMS

"How to Convert Your Auto to Propane"
Arrakis Propane Conversions
Route 2, Box 966
Leslie, Ark 72645



"FOOD AND FUEL FOR THE FUTURE"